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**(71) Applicant(s)**

**Alan William Robinson**

**9 Romney Wynd, Clifton Park, RAMSEY, IM8 3NJ,  
Isle of Man**

(72) Inventor(s)

**Alan William Robinson**

**(74) Agent and/or Address for Service**

**Alan William Robinson**

**9 Romney Wynd, Clifton Park, RAMSEY, IM8 3NJ,  
Isle of Man**

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(56) Documents Cited

None

**(58) Field of Search**

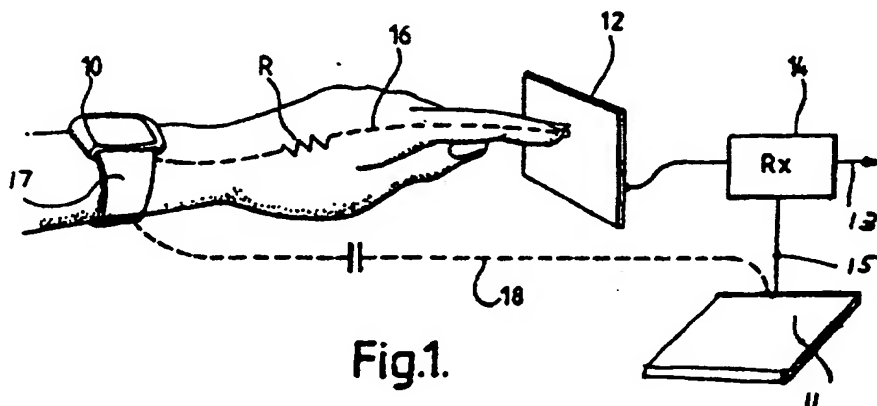
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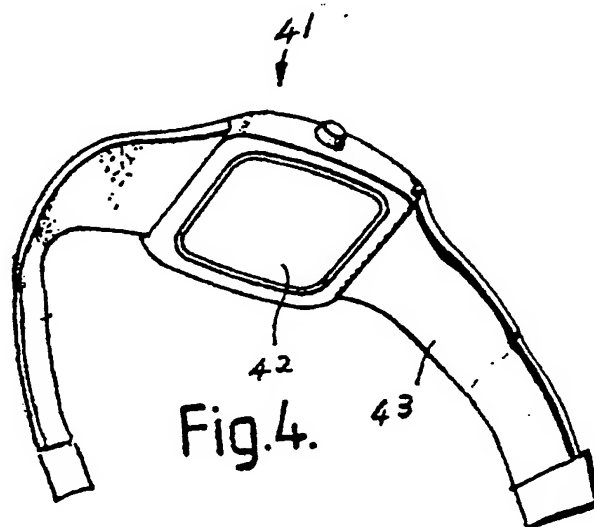
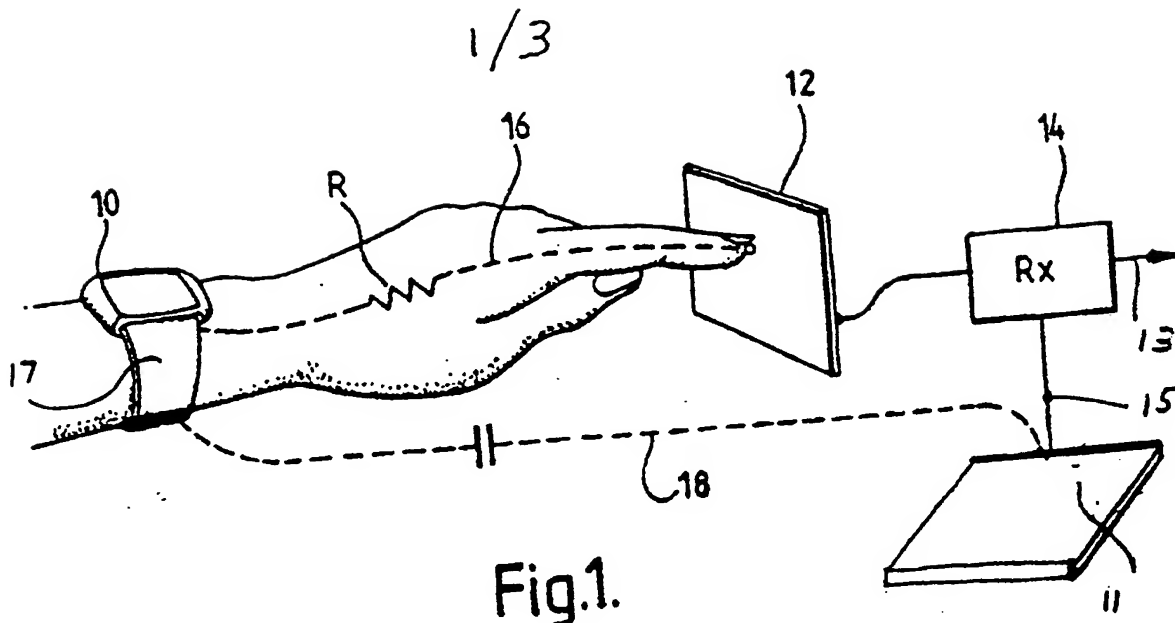
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**(54) Personnel identification system**

(57) To provide reliable and practical operation of a system for the identification of personnel employing an individual's skin as an electronic signal transmission medium, with the signal (coded) coming from a device 10 in the style of a wristwatch or bracelet, signal and reference contact plates are on opposite sides of the wrist or arm. To save battery power, the device may transmit only in response to a coded interrogation from outside.



GB 2 306 725 A



2/3

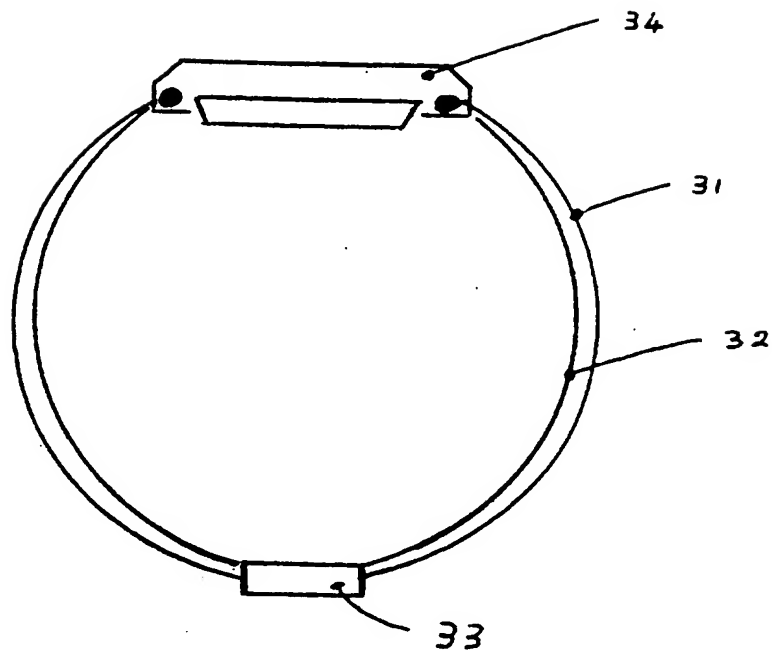


Fig. 3.

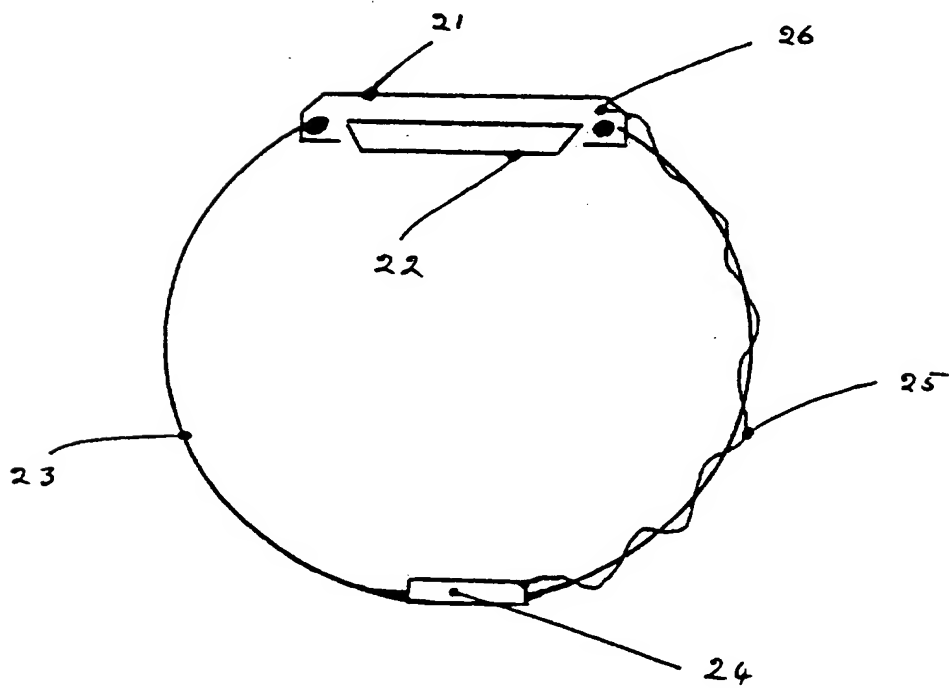


Fig. 2.

3/3

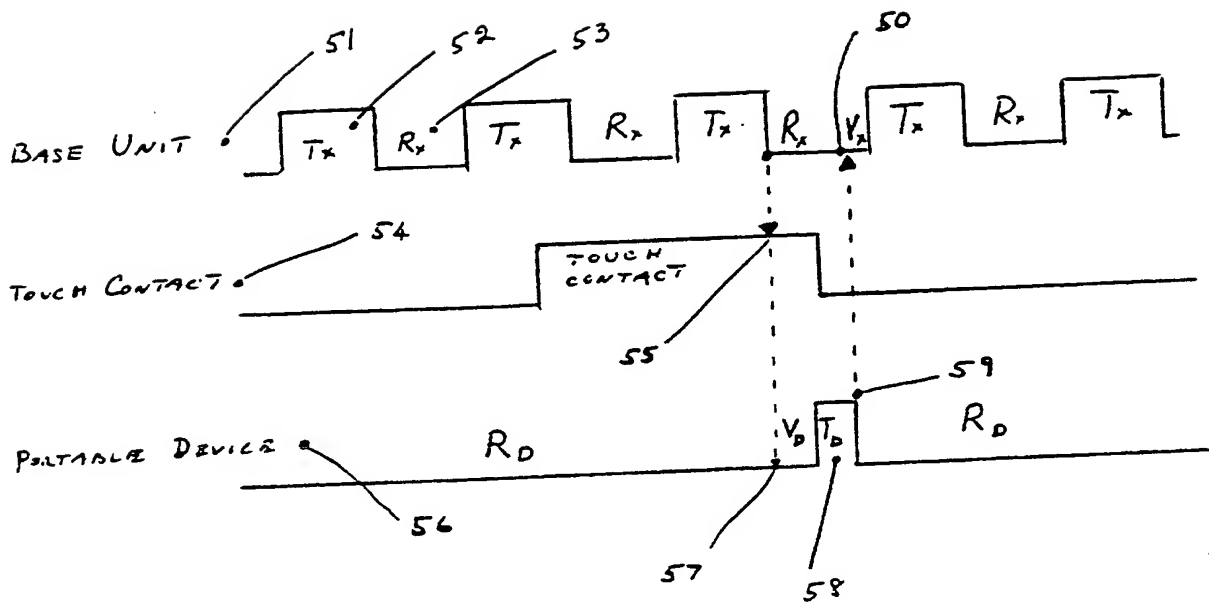


Fig. 5.

### Personnel Identification System

A method is known for the identification of individuals whereby a suitable portable electronic device held or worn by an individual is used to apply a time variant electronic coded signal to one point on the individual's skin surface enabling this signal to be detected by a suitable base unit, consisting of an electronic sensing device, via a touch sensor plate for collecting the signal from another point on the individual's skin surface. The individual's skin is thus used as a transmission medium for the electronic signal, providing a mechanism whereby the individual may be identified simply by touching the appropriate electronic sensing device. Such an arrangement has been described in UK Patent No. 2129176 and associated applications elsewhere in the world.

This invention relates to improvements and additions to the method thus described which are necessary for implementation of a functionally reliable system. A basic system comprises (i) a portable device which may be in the style of a

bracelet or wristwatch consisting of a case (41) Fig. 4, to house the electronic encoder circuitry, having a signal output and a reference output, a suitable conductive element backplate (42) to permit transfer of an electronic coded signal to the wearer's wrist, and a conductive strap (43) for both securing the device and providing the electronic reference signal.

(ii) a base unit consisting of a conductive element touch plate (12) - fig 1 for receiving the electronic signal from the portable device (10) via conduction through the wearer's skin (16), an amplifier and discriminator circuit (14) for detecting and validating the received signal and implementing the desired action output (13) as a consequence.

Practical problems have been encountered in implementing a reliable system in this form to identify individuals based on an electronic coded signal which is applied to the skin surface of the individual.

A major difficulty in achieving reliable operation of such a system is brought about by virtue of the variable nature of the effective electrical impedance of the skin of the individual under various conditions particularly relating to temperature and humidity. Under the most adverse conditions the applied signal is loaded by the skin's low

impedance and the resultant signal amplitude transmitted to other areas of the body is greatly reduced resulting in potential malfunction of the system, whilst under differing conditions the skin impedance can be greatly increased reducing the effective electrical current flow to the base unit.

To overcome the first problem it has been found necessary, with respect to the portable device, to provide an electrical reference point as remote from the transmitted signal contact point as possible within the constraints of practical packaging, whilst the second problem has been overcome by increasing the transmitted electrical signal power.

Solution to the first problem has been achieved by using a portable device - Fig 2, in form similar to a wrist watch or bracelet consisting of a case (21) for housing the electronics an exposed conductive element backplate (22) for applying the encoded signal to the skin surface, together with an insulated strap (23) having an exposed reference conductive element (24) in contact with the wearer's skin only in the region of the strap farthest from the conductive element backplate part of the device, thus permitting application of the electrical signal to one side of the wearer's wrist and application of the electrical reference

signal to the opposite side of the wearer's wrist.

The insulated strap provides an insulated material (23) in contact with the skin, but carries an insulated conductor (25) for connecting the electrical circuit reference voltage point (26) within the case to the exposed conductive element (24) of the strap.

Alternatively, with reference to Fig 3, the strap (31) can be continuously electrically conductive, connecting the exposed reference conductive element (33) to the electrical reference voltage point (34) within the case, but has an inner insulating layer (32) which prevents contact with the skin of the wrist everywhere except in the region of the exposed conductive element (33).

In certain implementations it has been found effective to insulate the reference element also, thus providing a capacitive electrical connection to the wearer's skin.

Solution to the second problem has been achieved by suitable circuitry for increasing the power level of the signal applied to the skin surface, but this method suffers from the practical limitation brought about by the short life expectancy of the power cells housed within the device casing when required to produce higher levels of power



output continuously.

To overcome this deficiency the design is modified to include a receiving circuit within the portable device casing which is connected via the same electrical path through the skin to the base unit described, which first detects a command signal transmission originating from the base unit via the touch element when contacted by the individual. Only when a suitable transmission is detected by the device circuitry corresponding to an acceptable command code does the device switch from receive mode to transmit mode to send its identification code to the base unit, before resuming operation once more in the receiving mode in anticipation of a subsequent command code transmission from the base unit being detected next time touch contact by the individual re-establishes the circuit. In this way the duration of overall signal transmission by the portable device can be kept extremely short thus prolonging the life of the electrical cells within the portable device to practical levels.

The respective transmission and receipt of signals between base unit and portable device thus operate in half duplex mode. The protocol is outlined in Figure 5 where, the base unit waveform (51) is shown switching between transmission

mode (52) and receiving mode (53) continuously. The touch contact waveform (54) shows the point in time the individual arbitrarily establishes the circuit by touching the sensor plate and enabling the base unit command code to the portable device (55). In consequence the portable device waveform (56) shows the commencement of the validation process (57) and the resultant code transmission (58) of the portable device, which thereafter reverts to the receiving mode (59) pending receipt of the next valid command code. Meanwhile the base unit validation and activation process is shown at (50) follows receipt of the portable device coded signal prior to the base unit reverting to its original sequence shown in (51).

The security of the overall system is enhanced when the command signal is varied through a large number of combinations each being acceptable to the portable device receiving circuitry but resulting in the device transmitting a specific part of its code dependent on the command code received. In this way attempts to monitor and analyse correct signal transmissions by a third party are minimised. The code transmitted by the device may consist of a part dependent on the command code received, and a part which is specific to identification of the wearer - the complete

transmission thus being dependent on the command code received, whilst providing the wearer's identity code consistently.

The variable nature of the skin electrical impedance described earlier causes the signal amplitude on the skin surface to vary, which in turn causes the electrical signal amplitude detected at the touch plate to vary. It has been found that the signal received at the base unit can be established more consistently by the use of a ground reference plate (11) - Fig 1, at some distance from the base unit electronic circuitry and connected by an electrical conductor (15) to the power supply reference point of the base unit. The ground reference plate may take various forms but in essence may be any piece of metal of high electrical conductivity having an area of several square centimetres, typically 15 cms x 10 cms has proven to be effective.

Additionally, electrical connection to the wearer's skin can be improved by the use of a knurled, serrated or similar roughened surface finish being provided on the various conductive elements in contact with the skin, which serves to increase the localised contact pressure improving conductivity. This improvement applies equally to the backplate of the portable device, the voltage reference

point, and the touch plate of the base unit and can provide particular benefits when the skin is dry or hardened which causes an increase in the electrical impedance of the skin.

The improvements and additions detailed result in a practical and useful system which has the dual benefits of being more secure than conventional systems because of the localised nature of the electrical signal conduction through the user's skin and less cumbersome in operation because the system is initiated simply through the normal actions of the operator holding or touching the appropriate part of the existing equipment, suitably modified to produce an electrically conductive touch plate element.

A number of applications have been invented using the system which are listed below and further described.

(1) Time and Motion Studies.

In situations where the actions of individuals in a particular environment need to be monitored over a period of time, each individual wears a unique portable device and a plurality of electrically conductive touch plate element and associated base unit positions are monitored by a control computer to store and/or analyse the respective movements or actions of each individual. Specific instances are numerous

but as an example multiple sales personnel operating in a common retail environment can be monitored and statistics produced based on various performance criteria. In this example, the electrically conductive touch plate elements are incorporated within the point of sale equipment normally handled by the operator.

### (2) Vehicle Entry

The electrically conductive touch plate element can be formed from the normal arrangement of a vehicle door handle which is suitably insulated from the surrounding metalwork of the vehicle door. An operator wearing a suitable portable device is able to activate the unlocking mechanism of the door simply by holding the handle in the normal process of attempting to open the door. To lock the door on leaving the vehicle the operator simply touches the door handle after closing the door.

### (3) Building Entry Control

The electrically conductive touch plate element can be formed from the normal arrangement of a door handle or door push plate. An operator wearing a suitable portable device is able to activate the unlocking mechanism of the door by holding the door handle or by pressing with the palm of the hand against the push plate. The mechanism is arranged to automatically lock again once the door is allowed to swing closed.

#### (4) Security Systems

An electrically conductive touch plate element in a suitable form is incorporated at a convenient position on a door or wall, say, internal or external to the area being secured, allowing an individual wearing a suitable portable device to arm or disarm the security system at will.

#### (5) Machine Operation Control

Operation of industrial machines, commercial appliances or similar equipment can be enabled (or indeed inhibited as appropriate) by providing electrically conductive touch plate elements at suitable points of the machine to be operated. Examples of suitable points being levers, handles, push buttons or other normal control points.

#### (6) Safety Access

Access to specific areas or use of hazardous equipment can be restricted to individuals wearing an appropriate portable device, whilst suitable electrically conductive touch plate element's are incorporated as necessary.

#### (7) Hand Held Equipment

The use of hand held equipment such as power tools, domestic appliances and the like can be confined to use by specific individuals wearing suitable portable devices. An electrically conductive touch plate element is formed from an existing part of the equipment, such as the hand grip of an electric drill for example, and the output signal from

the base unit housed within the equipment is used to act as an interlock to the control circuitry of the equipment.

(8) Equipment for Disabled Persons

Access to specific areas and control of equipment by blind or disabled personnel can be facilitated more easily using the system because of the lack of need to undertake any extra action beyond that normally required.

Again, the individual wearing a suitable portable device makes skin contact with the electrically conductive touch plate element of the specific equipment, and the output of the base unit enables the desired function by electrical and/or mechanical means.

(9) Hand Held Firearms

The use of hand held firearms can be limited to authorised personnel when the authorised user wears an appropriate portable device. The grip, handle or trigger of the gun, rifle or similar weapon is arranged to provide an electrically conductive touch plate element, and the output of the base unit is arranged to provide a mechanical and/or electrical/electronic interlock inhibiting the weapon from being used except when the correct signal from the portable device is detected.

This arrangement is equally suitable for restricting the use of more modern weapons such as electric stun guns or weapons using laser power.

(10) Secure use of Information Technology Products

Use of products in the Information Technology field such as computer terminals, telephones, cash points and similar equipment can all be restricted to authorised use in the same way as already described.

It is fundamental to the use of the systems earlier described that each individual needs to wear a portable device having a code transmission unique to the individual concerned. It may be advantageous for the specific code selected to be the number used for the individuals existing credit card or similar number. It can be contemplated that such a number code transmission generated by the portable device could provide access for a user to his motor vehicle, home and work premises, cash point machines and all other equipment which requires to be limited to use or control by the individual or a group of individuals.



## CLAIMS

1. A personnel identification system using an individual's skin as a medium for transmission of an electronic coded signal wherein the system comprises:

(i) a portable device in the style of a wrist watch or bracelet where an electronic encoder housed within the device has a signal output and a reference output, and wherein the device has an electrically conductive backplate element in contact with the user's skin on one side of the wrist or arm connected to the signal output, and the strap is electrically insulated from the user's skin everywhere except for an electrically conductive element in the region remote from the backplate on the other side of the wrist, which is connected to the reference output circuit.

(ii) a base unit consisting of one or more physical housings, to be electrically coupled to the said equipment, comprising an exposed electrically conductive touch plate element for receiving the coded signal when touched by the individual, amplification and discrimination circuitry for comparing the detected signal with internal stored validation code or codes and output circuitry for implementing the desired action when validation is confirmed.

2. A personnel identification system using an individual's skin as a medium for transmission of an electronic coded signal wherein the system comprises:

(i) a portable device in the style of a wrist watch or bracelet where an electronic encoder housed within the device has a signal output and a reference output, and wherein the device has an electrically conductive backplate element in contact with the user's skin on one side of the wrist or arm connected to the signal output, and the strap is electrically insulated from the user's skin and is connected to the reference output circuit.

(ii) a base unit consisting of one or more physical housings, to be electrically coupled to the said equipment, comprising an exposed electrically conductive touch plate element for receiving the coded signal when touched by the individual, amplification and discrimination circuitry for comparing the detected signal with internal stored validation code or codes and output circuitry for implementing the desired action when validation is confirmed.

3. A personnel identification system using an individual's skin as a medium for transmission of an electronic coded signal wherein the system comprises:

(i) a portable device in the style of a wrist watch or

bracelet where an electronic encoder housed within the device transmits its identification code infrequently

(ii) a base unit consisting of one or more physical housings, to be electrically coupled to the said equipment, comprising an exposed electrically conductive touch plate for receiving the coded signal when touched by the individual, amplification and discrimination circuitry for comparing the detected signal with internal stored validation code or codes and output circuitry for implementing the desired action when validation is confirmed.

4. A personnel identification system using an individual's skin as a medium for transmission of an electronic coded signal wherein the system comprises:

(i) a portable device in the style of a wrist watch or bracelet where the portable device acts in the main as a receiving device awaiting transmission from the base unit of a command code which can be decoded by the portable device as a valid command code transmission when the individual contacts the touch plate, causing the portable device to switch its action from a receiving device to a transmitting device in order to transmit its identification code to the

base unit for validation, and subsequently reverting to its action as a receiving device once more in anticipation of a further valid command code transmission being received from the base unit next time touch contact by the individual re-establishes the circuit.

(ii) a base unit consisting of one or more physical housings, to be electrically coupled to the said equipment, comprising an exposed electrically conductive touch plate for initially transmitting a command code signal generated within the base unit at predetermined intervals to the portable device , and briefly switching into a receiving mode of operation between each transmission to detect a valid response from the portable device when the individual is in contact with the touch plate, amplification and discrimination circuitry for comparing the detected signal with internal stored validation code or codes and output circuitry for implementing the desired action when validation is confirmed.

5. A personnel identification system according to claims 1 to 4 where the base unit's internal voltage reference point is connected at some distance via a suitable conductor to a conductive plate acting as a remote reference ground point for the electronic signal received at the touch plate of the control unit.

6. A personal identification system according to claim 5 where the conductive plate is substituted or complemented by the Earth conductor of a conventional power distribution system.

7. A personal identification system according to claims 1 to 6 where one or more of the exposed conducting elements in contact with the skin has a serrated, corrugated, protruded, irregular or similar surface for improving electrical contact between one or more conductive elements and the user's skin.

8. A personal identification system according to claims 1 to 7 where the portable device includes operation as a conventional time keeping watch.

9. A personal identification system according to claims 1 to 7 where the portable device does not include operation as a conventional time keeping watch.

10. A personal identification system according to claim 4 where the base unit transmits a range of command codes variably which are acceptable to the portable device and which cause the device, in turn, to transmit a complex code in part dependent on the particular command code and part on

the specific individual identification code.

11. A personnel identification system according to claims 1 to 10 where the electronic coded signal transmitted by the portable device relates to the individual's existing credit card or similar identification number.
12. An arrangement according to claims 1 to 11 where the electrically conductive touch plate element is in the form of a conventional vehicle door handle and the base unit output activates circuitry which enables operation of the standard electromechanical locking arrangement for the vehicle.
13. An arrangement according to claims 1 to 11 where the electrically conductive touch plate element is in the form of a conventional door handle or door push plate and the base unit output activates circuitry to release a door lock or similar mechanism permitting access to buildings or premises.
14. An arrangement according to claims 1 to 11 where the electrically conductive touch plate element is in the form of a suitably located touch plate and the base unit output

activates the arming and disarming circuitry of a conventional security system.

15. An arrangement according to claims 1 to 11 where the electrically conductive touch plate element is in the form of a conventional control handle, knob, or lever of an industrial machine, appliance or similar equipment, and the base unit output activates circuitry to enable the power circuits of the equipment.

16. An arrangement according to claims 1 to 11 for use in hand held equipment such as power tools, domestic appliances and the like, where the electrically conductive touch plate element is in the form of a conventional handle or grip of the item, and the base unit output activates circuitry to enable the power circuits of the equipment.

17. An arrangement according to claims 12 to 16 where access to locations or the use of equipment provides a means of controlling safety access.

18. An arrangement according to claims 12 to 16 where access to locations or the use of equipment provides a means for facilitating operation by blind or disabled personnel.

19. An arrangement according to claims 1 to 11 where the electrically conductive touch plate element is in the form of an existing handle, grip or trigger of a conventional hand-held firearm, gun, rifle or similar weapon and the output of the base unit, contained within the weapon casing, activates circuitry controlling mechanical and/or electrical interlock of the firing mechanism, permitting the weapon to be operated only by the wearer of a portable device with a valid code.

20. An arrangement according to claims 1 to 11 where the electrically conductive touch plate element is in the form of an existing handle, grip or trigger of a modern laser powered weapon, an electrical stun weapon, or similar equipment, and the base unit output activates the weapon's internal circuitry, enabling use of the weapon only by the wearer of a portable device with a valid code.

21. An arrangement according to claims 1 to 11 where the electrically conductive touch plate element is in the form of a suitable touch plate mounted on a computer, telephone, or cashpoint, terminal or other information technology product, and the base unit output is arranged to control circuitry which inhibits use of the terminal except by an individual wearing an appropriate portable device having a



valid code.

22. An arrangement according to claims 1 to 11 where a number of electrically conductive touch plate element's and base units are employed at various locations, each interfaced to a monitoring system or computer, and one or more individuals, each wearing a uniquely coded portable device, is/are monitored for movements and actions within the given environment.

23. A system constructed and arranged substantially as herein described.



# The Patent Office

22

**Application No:** GB 9523176.7 **Examiner:** Mike Davis  
**Claims searched:** 1 AND APPENDANCIES **Date of search:** 13 November 1996

## Patents Act 1977 Search Report under Section 17

### Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): G4H (HTG)

Int Cl (Ed.6): G07C

Other: Online: WPI

### Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
	None	

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.